Space Weather Forecast

Issued on Saturday, 20 May 2023 at 01:19 Local

This forecast provides a four-day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

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Space Weather Forecast Headline: Minor/Moderate R1/R2 radio blackouts from X-ray flares likely. Slight chance of G1 Minor Geomagnetic Storms from later in UTC weekend.

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been high over the past 24 hours, with X-ray activity showing several Moderate-class flares, these mostly originating from a large and complex sunspot group near the northeastern solar horizon. The largest of these flares resulted in an R2 Moderate radio blackout, peaking at 19/0048UTC.

There are currently around seven sunspot regions on the facing side of the Sun with three others fading away. Of the current cohort of spot groups, determination as to the complexity and therefore flare potential of the most active group in the northeast is being hampered by the narrow viewing angle. A second large spot group in the southeast which gave an M9.6 on 16 May is large but less complex overall. Many of the other regions on the Sun were smaller magnetic dipoles or else unipolar groups, while the main changes were confined to a third spot in the west, which saw proliferation of its intermediate spots for a time, with this succeeded by a spreading tendency later in the UTC day.

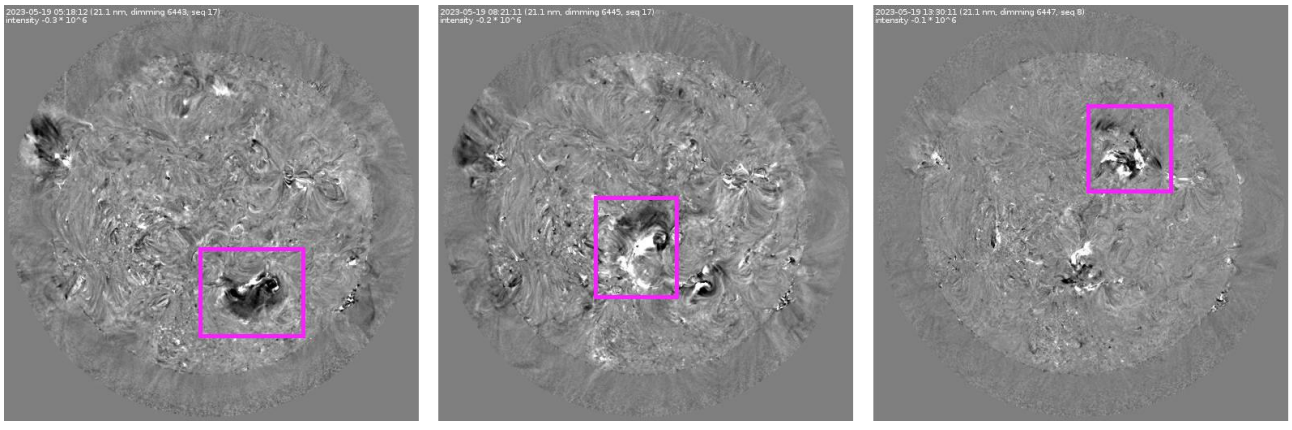

Figure 1: Three of the more noteworthy ‘filament’-related events on the Sun in the past 24 hours, although as yet none of these has produced a confirmed Earth-directed CME. The above are all time-integrated extreme UV image sequences processed by SIDC ROB.

The Sun has seen numerous 'filaments' (arcs of plasma) become mobile or else disappear in the past 36 hours or so. Perhaps the most relevant observed in the 24-hour period were one from the southwest at 19/0530UTC, which produced a CME seen heading largely south and west of the track of the Earth's orbit. This has been modelled as a miss. This in turn sparked movement in a more central filament from 19/0830UTC, with this feature remaining mobile for several hours following, but perhaps not resulting in any lift-off, with no obvious subsequent ejecta on satellite

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imagery. Thirdly, in the northwest, another filament disappeared around 19/1300UTC, as seen on ground-based near-infrared imagery. This may be the progenitor of a narrow and faint CME heading north and west, although its appearance is perhaps too immediate. Whatever the cause of this CME, provisionally it appears too narrow, north and west to have any bearing on conditions at Earth, with modelling results awaited.

No new Earth-directed CMEs were therefore in evidence at the time of writing, although confidence in this statement is lower than typical given the weight of events.

Solar Wind / Geomagnetic Activity: The solar wind was suggestive of a slow regime for much of the period, however this transitioned into a possible precursor to an anticipated coronal hole fast wind through the UTC evening.

The solar wind speed was at background levels but with a slight rising trend. The number of particles in the solar wind started within background levels, but became elevated by 19/2130UTC. This was a precursor to a step-wise change upwards in the associated solar wind magnetic field with a flat background previously observed rising to a slightly elevated peak. The north-south component was initially small scale and stable, but this gave way to a larger magnitude and mostly anti-aligned behaviour (with Earth's field) in the UTC evening.

The net effect of the above solar wind measures was nevertheless for mainly quiet activity, but with a general increase observed as the 24-hour period ended.

Energetic Particles / Solar Radiation: Solar radiation levels continued their slow decline in the wake of 16 May's large proton-producing X-ray flare from the southeastern large sunspot group, and are now very near resting Background levels, having peaked at 0.8pfu - i.e. roughly a decade below S1 - Minor Solar Radiation Storm.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to remain moderate, with a slight chance of Strong-class X-ray flares throughout the period, with the northeast and southeast large sunspots being the most likely sources of these flares. No new large regions are expected to arrive, however the growing western sunspot region leaves the facing side by day four, leading to a slight decrease in flare risk by the very end of the forecast.

Solar Wind / Geomagnetic Activity: The only CME that features in the forecast is a southwestern filament eruption from 17 May - possibly glancing Earth on or after the middle of the UTC day of Sunday 21 May to give a slight chance of Minor Geomagnetic Storm G1.

In terms of fast winds, a minor 'coronal hole' may affect Earth shortly, but is not likely to be impactful over the current UTC weekend. More significant are larger and more intense coronal holes further east on the solar disc, the latter of which may round-out the four-day forecast with a slight chance of G1.

Energetic Particles / Solar Radiation: There is a daily slight chance of S1, largely as a result of the eastern hemisphere spots, with this very gradually rising over the four days as they move westwards.

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Geomagnetic Storms:

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	20	20	5	20
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Radio Blackouts - X Ray Flares:

X Ray Flares Probability	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	R1-R2 M Class	Yes	70	70	70	60
Very Active	R3 to R5 X	No	15	15	15	10

Solar Radiation Storms - (High Energy Protons):

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	≥ S1	No	10	10	15	15
Very Active	≥ S3 *	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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